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# Update on inflation of journal prices: Brandon/Hill list journals and the scientific, technical, and medical publishing market\*

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**Objective:** The original study of journal prices, using the "Brandon/Hill Selected List of Books and Journals for the Small Medical Library," was first published in 1980 and periodically updated. This research continues to measure price increases for these titles for the periods 1996 to 1999 and 1999 to 2002.

**Methodology:** The 111 journal titles that have appeared in each published list from 1967 to 2001 were included in the study. Institutional subscription price data were gathered for each journal for the years 1996, 1999, and 2002 and were compared to the Consumer Price Index (CPI) for the same years.

**Results:** The average journal price continues to rise significantly and is independent of the CPI. The study found that prices have jumped 51.9% from 1996 to 1999 and 32% from 1999 to 2002, which is consistent with nearly every recent journal price study.

**Conclusion:** The unprecedented rise in journal prices negatively affects the purchasing power of medical libraries. This paper examines the economic and technological pressures on the science, technology, and medical journals market that contribute to high prices and identifies a number of initiatives in the biological and health sciences that utilize alternative models for disseminating scientific research.

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## INTRODUCTION

Many hospitals and academic institutions are experiencing budget cuts in response to the current economic downturn, and health sciences librarians find themselves caught in the squeeze as they also face rapidly increasing prices for journals, the mainstay of their library collections. Medical librarians and administrators need reliable data to assist them in understanding

the trends they are facing, so they can make strategic decisions about the future of their libraries. This paper continues the study of journal price increases, based on the "Brandon/Hill Selected List of Books and Journals for the Small Medical Library" [1], that was first published in 1980 and last updated in 1996 [2-5]. Through the years, this study has provided a method for systematically analyzing journal budgets in relation to other costs as measured by the US Consumer Price Index (CPI).

The results of this 2002 update show that the average journal price continues to rise significantly and is independent of the low inflation rate in evidence for

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over a decade. The authors find that prices have jumped 51.90% from 1996 to 1999 and 32% from 1999 to 2002, which is consistent with nearly every recent study of journal prices. *Library Journal* reports a 35.63% increase for health sciences journals from 1999 to 2003 [6], while the American Library Association's *U.S. Periodical Prices, 2002*, shows increases of 53.20% from 1996 to 1999 and 29.30% from 1999 to 2002 for journals in medicine [7]. The most recent Index Medicus price study indicates an average price increase of 51.50% for the period 1994 to 1998, with 32 of those titles showing an increase of 200.00% or higher [8].

To provide a context for this rise in journal prices, this paper also examines the economic and technological pressures on journals in the science, technology, and medical (STM) market that are contributing to high prices. One trend has been the dramatic movement toward electronic journals since the last study six years ago. Over 95% of the journal titles in the study are now available in an electronic format, some through commercial aggregators and others directly from the publishers. This shift in a relatively short period of time has had consequences for publishers, libraries, and, ultimately, journal prices.

Printed STM journals have historically provided scientists and researchers with the means to communicate their research results to the scientific community at large while also serving as the authoritative scholarly record. At a time when information technology is making it possible to disseminate research more broadly, old pricing models that generate revenue from libraries and users in the form of subscriptions may be increasing the barriers to scholarly communication. A number of initiatives in the biological and health sciences are experimenting with alternative financial and technological models for disseminating scholarly research, and this paper presents an overview of the major ones. The outcome of these experiments may have profound effects on medical libraries and their clients in the future.

## METHODS

Since it was first published in 1965 in the *Bulletin of the Medical Library Association (BMLA)*, the "Brandon/Hill Selected List of Books and Journals for the Small Medical Library" has evolved into a standard selection tool for health sciences librarians in small- and medium-sized libraries. The most recent list was published in 2001 and included 143 journal titles. Journal titles that have been published for at least 35 years were included in the current study. A name change did not eliminate a title from the list, as long as the journal did not cease publication during that time. This method provided the necessary consistency in comparing prices over the 35-year period. Using this method, 111 titles (79%) were retained out of the 143 titles. Price information was gathered every 4 years with the exception of the 3-year period 1999 to 2002. Prices for an institutional print subscription in the United States were taken ei-

ther from the Brandon/Hill List or directly from the journals themselves.

The Consumer Price Index for all Urban Consumers (CPI-U) for the US City Average for All Items is the most widely used measurement of the general rate of inflation in the United States [9]. The CPI is produced by the US Bureau of Labor Statistics and measures the average change over time of prices paid by urban consumers for a representative selection of goods and services. Calculating the percent change between index points provides a reliable indicator of US inflation, one that is used both by government and business [10]. The study uses the average rate for the year from the CPI-U for this calculation to establish the standard against which to compare the percent change in the average journal price for the same time period.

## RESULTS

Table 1 displays the data used to calculate the results: the total cost and average cost of the 111 journals for each of the periods covered and the CPI for the same years. One figure of interest is the "journal cumulated % increase" for 2002, which shows the increase for the 28-year period to be more than 2,300%. The study originally determined that it would have cost \$1,643.00 to purchase all the titles on the 1967 Brandon/Hill list, a figure that has ballooned to \$40,406.00 today. In 1995, a hospital library with a budget that had increased at a rate corresponding to the CPI could purchase 37% of the journals it had purchased in 1967, with a decline to 27% by 1999 and to 20% in 2002.

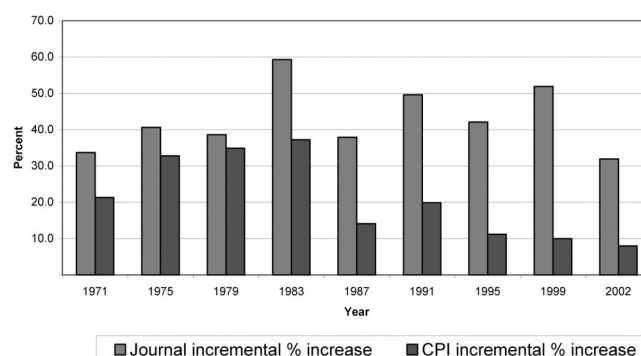
Figure 1 compares the incremental percent increase of journal prices and the CPI for each of the four-year time periods. Especially significant is the widening disparity between the two variables since 1995. During this time, the CPI increases hovered around 10.0%. In direct contrast, during the period ending 1995, journal prices increased 30.9% over the CPI; in 1999, prices had increased 41.9%, and, in 2002, which covered only a 3-year period, the increase was 23.9%. This clearly shows how the inflationary trend in the United States as a whole has dramatically slowed, while the rate of increase in cost for the journals on the Brandon/Hill list has continued unabated.

Figure 2 shows the cumulative decline in the buying power in the dollar as represented by the CPI and the dollar in a small medical library's budget for acquiring journals. This figure is obtained by calculating the cumulative percent change first in the average journal price over time using 1967 as the base year and then for the CPI for the same period. While the general inflation rate has declined dramatically in the last decade, the relative spread between the two has continued to grow. Figure 3 shows this spread by presenting the buying power of the journal acquisition dollar as a percent of the value of the CPI dollar. Using 1967 as the base year, a library whose journal acquisition budget has increased from 1967 to 2002 at the same rate as the CPI, in 2002, could purchase only 20% of the journals it could have in 1967. A hospital library that

**Table 1**  
Data and calculations from journal prices and Consumer Price Index (CPI)

	1967	1971	1975	1979	1983	1987	1991	1995	1999	2002
Total cost	\$1,643.00	\$2,217.00	\$3,117.00	\$4,320.00	\$6,882.00	\$9,490.00	\$14,197.00	\$20,168.00	\$30,632.00	\$40,406.00
Average journal price	14.94	19.97	28.08	38.92	62.00	85.49	127.89	181.69	275.96	364.01
Journal incremental % increase		33.71	40.62	38.57	59.33	37.88	49.60	42.07	51.88	31.91
Journal cumulative % increase since 1967		33.71	88.03	160.56	315.14	472.41	756.30	1,116.53	1,747.68	2,337.25
Consumer Price Index (CPI)	33.40	40.50	53.80	72.60	99.60	113.60	136.20	151.40	166.60	179.90
CPI incremental % increase		21.26	32.84	34.94	37.19	14.06	19.89	11.16	10.04	7.98
CPI cumulative % increase since 1967		21.26	61.08	117.37	198.20	240.12	307.78	353.29	398.80	438.62
Cumulative % of buying power: journal		0.75	0.53	0.38	0.24	0.17	0.12	0.08	0.05	0.04
Cumulative % of buying power: CPI		0.82	0.62	0.46	0.34	0.29	0.25	0.22	0.20	0.19
Cumulative % buying power ratio: 1967 incremental % increase ratio		0.91	0.86	0.83	0.72	0.59	0.48	0.37	0.27	0.20
		1.59	1.24	1.10	1.60	2.70	2.49	3.77	5.17	4.00

**Figure 1**  
Inflation of medical journal prices versus Consumer Price Index (CPI)



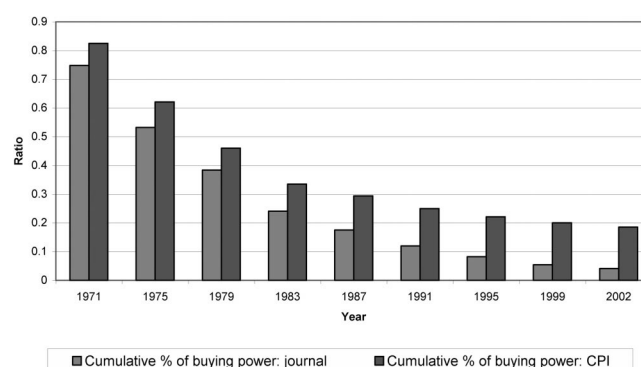
realized increases equal to the rate of inflation for the past 35 years was fortunate but has still suffered a dramatic erosion of its purchasing power. Meanwhile, the number of journals published in 2002 is dramatically higher than in 1967, adding even greater pressures on a library's budget.

## DISCUSSION

So why have journal prices in the health sciences continued to rise out of proportion to the general rate of inflation? It is important to put the data that have been collected into the context of the current climate surrounding journal pricing. The literature reveals a number of complex answers to the question and, as one may expect, diverse points of view on the matter. The main focus of debate has been on the STM journals market, where the prices have increased most dramatically. Unsurprisingly, publishers and librarians have taken up opposing sides and see the problem of increasing prices and the potential solutions quite differently.

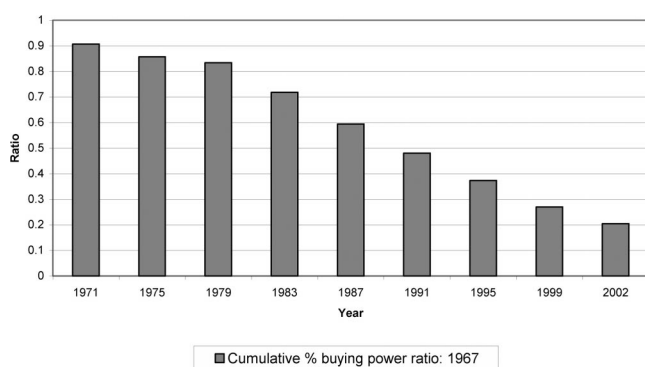
To assist in this sometimes heated debate, Tenopir and King have conducted comprehensive studies that

**Figure 2**  
Decline in purchasing power for medical journals versus all consumer goods since 1967



**Figure 3**

Buying power ratio since 1967 for medical journals (CPI/journal price)



have produced detailed information and data that quantify nearly every aspect of STM journals and scholarly communications [11]. The start-up and on-going operational costs of publishing a scientific print journal are not inconsequential as evidenced by the models that include detailed costs for activities such as article processing, reproduction, distribution, and marketing [12]. Tenopir and King have also looked at the significant financial investments that publishers have had to undertake as they have moved into electronic publishing [13]. Publishers have had to purchase the equipment and design the platforms necessary for the electronic distribution and searchability of STM journals. This includes the cost of archival storage, a new responsibility for publishers, because libraries have historically provided that function for print journals. These investments have created added value for libraries and their users, but they have been in addition to the fixed costs of continuing to publish the print versions.

Tenopir and King identify another factor that has influenced the higher cost of publishing print journals. They estimate that the number of scientists in the United States has increased from 1.87 million in 1965 to nearly 6.80 million in 2000 [14]. For the most part, the number of articles published per scientist has remained steady over time, although university scientists show an increased output over the last 2 decades [15]. The resulting explosion in the number of scientific articles written has put pressure on publishers to increase the number of articles they publish, contributing to the trend of publishing more articles in each journal issue. In 1975, the average number of articles per journal was 85, which jumped to 123 in 1995 [16]. This has driven up the publishers' costs for paper, printing, and labor.

Naturally, publishers have passed on their higher costs by increasing journal subscription prices. These increases, coupled with improvements in remote access to libraries' electronic journals, have created incentives for physicians and other health professionals to cancel some of their personal subscriptions to medical journals, particularly those that are more periph-

eral to their interests. Tenopir and King report that in 1977 nonuniversity scientists subscribed to an average of 6.20 scholarly journals. By 1998, that number had been reduced to 2.44 [17]. This decrease has had the effect of forcing publishers to recover their increasing fixed costs from a shrinking pool of subscribers. Libraries have struggled to maintain their subscriptions by absorbing the higher costs at a time when many budgets are stagnating.

Societies that publish prestigious journals are not exempt from the pressures of rising costs and may, in some cases, be faced with the need to cover a portion of their institution's operating and other costs. Where society publishers were once relied upon to price their institutional subscriptions at a more affordable cost to libraries than commercial publishers, this is no longer the case. In 1995, the average institutional price of an STM journal published by a society was less than half the cost of a commercial journal [18]. Now, their price increases often mirror and, in some cases, exceed the dramatic increases being passed on by the commercial publishers.

In recent years, librarians have often placed the blame for spiraling prices on commercial publishers and their relentless drive toward profits. A 2003 report by the Information Access Alliance, a group of six library associations including the Medical Library Association, argues that mergers have reduced market competition in the industry and are a significant cause of high journal prices. The report goes on to appeal to the US antitrust enforcement authorities to step in with remedial action to protect the public interest [19].

Likewise, Britain's Office of Fair Trading (OFT) published a report in September 2002 that targeted the STM journal market for concerns about price increases above inflation, high profit margins of commercial publishers, and concentration of market share [20]. The report noted that Reed Elsevier, the largest publisher of scientific journals, maintained 41% of the STM journal market in the United Kingdom, giving the company the ability to exert considerable control over prices. Another study, cited in the report, compared the profit margins of four major commercial STM publishers against the industry average of 5.0% and concluded that Reed Elsevier's net margin (profit to stockholders) exceeded the average by 22.3%, with 2 of the other publishers also falling near the upper quartile [21]. Despite these figures, neither the OFT nor the Department of Justice have chosen to intervene with regulatory measures.

Publishers are indeed using whatever tools they have to strengthen their standing in the electronic journals market. In the last few years, portfolio pricing or "bundling" has become popular. In this model, publishers offer electronic access to all or a portion of their journal titles and charge a single packaged price. Librarians have found this to be an easy way to rapidly build a digital collection, enabling them to cancel some of their print subscriptions. Bundling is advantageous for the publishers, because they can gather their strong and weak titles together into a single product, which



becomes "indispensable" to their customers. Librarians cannot drop one title without dropping the whole package, which in effect gives the bundle the value of its most prestigious journal title. An unintended consequence is that by restricting their purchases to such "Big Deals," librarians may be hastening the demise of the smaller or niche publishers, thereby reducing competition even more [22].

High journal prices and lack of competition in the STM journal market create barriers to the wide distribution of scientific discovery, and those barriers in turn have serious consequences for the public interest. According to a recent RAND report, the US federal government spent more than \$21.2 billion of taxpayer money in 2002 to fund research and development in the life sciences alone [23]. Results of this funded research are eventually written, submitted for peer review and validation, and accepted or rejected for publication in the scientific journal literature. This scholarly communication plays an important role in translating research from the laboratory into life-saving drugs, treatments, and diagnostic tests that benefit society and improve the quality of life of its citizens. In the final analysis, barriers that impede this communication may ultimately cost lives.

In spite of the seriousness of the consequences, libraries often have little choice except to continue deselecting journal titles from their collections, relinquishing their print subscriptions in favor of electronic only, cutting their book budgets, and pondering layoffs of staff to continue purchasing critical journals. While these actions are taking place in libraries throughout the world, a number of initiatives give hope to those in the scientific and library communities who want to see change in the way scholarly research is disseminated.

## INITIATIVES FOR CHANGE

The Scholarly Publishing and Academic Resources Coalition (SPARC)<sup>†</sup> is one of the leaders of this movement to create change in scholarly publishing. It was formed in 1998 in an effort to unite committed universities, research libraries, and organizations across the world for the purpose of finding and supporting new and innovative ways to expand the dissemination of scholarly research and to create competition in a dysfunctional STM market. Rather than become publishers themselves, SPARC forms partnerships with publishers that share its vision. Early on, SPARC provided support in starting low-cost journals that compete directly with higher-priced titles. It was also instrumental in providing funding for BioOne,<sup>‡</sup> which offers an affordable way for smaller, nonprofit publishers in the biological and environmental sciences to create electronic versions of their print journals and make them available through aggregators. Most im-

portantly, SPARC is playing a key role in promoting the concept of open access publishing.

The term "open access publishing" has been defined as the free availability of scientific and scholarly research literature on the public Internet,

permitting any user to read, download, copy, distribute, print, search, or link to the full texts of these articles, crawl them for indexing, pass them as data to software, or use them for any other lawful purpose, without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. [24]

This clearly represents a radical departure from the traditional model of disseminating scholarly research in which the potential reader of the article bears the cost in the form of paid subscriptions or affiliation with a library or institution with a paid subscription. Instead of imposing restrictions and limiting the potential number of readers, open access removes them, resulting in a wider and more rapid dissemination of scientific research.

Scientists and researchers throughout the world are embracing the potential of the Internet and open access as a means for building "a global and interactive representation of human knowledge, including cultural heritage and the guarantee of worldwide access" [25]. A number of initiatives from government, nonprofit, and commercial sectors are exploring different approaches for implementing the open access concept. One example is PubMed Central,<sup>§</sup> an electronic archive for full-text journal articles in the life sciences, which offers free and unrestricted access to its contents. It was developed and is operated by the National Center for Biotechnology Information (NCBI) of the US National Library of Medicine. Participation by publishers is voluntary, but only journals that are peer reviewed and meet other editorial standards are included in the archive. Every full-text article in PubMed Central has a corresponding entry in PubMed, which also includes links to this full-text content. PubMed Central has a commitment to provide open access to this literature for the long term.

The Public Library of Science (PLOS)<sup>\*\*</sup> is a nonprofit organization of scientists and physicians whose goal is to encourage the free availability of scientific research on the public Internet. PLoS initiated an open letter in which signers pledged, beginning in September 2001,

to publish in, edit or review for, and personally subscribe to only those scholarly and scientific journals that have agreed to grant unrestricted free distribution rights to any and all original research reports that they have published, through PubMed Central and similar online public resources, within 6 months of their initial publication date. [26]

Over 30,000 scientists from 180 countries, signaling

<sup>†</sup> The Scholarly Publishing and Academic Resources Coalition Website may be viewed at <http://www.arl.org/sparc/>.

<sup>‡</sup> The BioOne Website may be viewed at <http://www.bioone.org>.

<sup>§</sup> The PubMed Central Website may be viewed at <http://www.pubmedcentral.nih.gov>.

<sup>\*\*</sup> The Public Library of Science Website may be viewed at <http://www.publiclibraryofscience.org>.

broad support from the scientific community, signed the open letter. To provide a model for open access publishing, PLoS is launching two peer-reviewed journals, *PLoS Biology* and *PLoS Medicine*, which adhere to this commitment.

BioMed Central (BMC)<sup>††</sup> is a commercial publisher of more than 100 open access biomedical journals, whose published research is made available for free and in perpetuity in the BMC digital archive. All journals are peer reviewed, and authors retain copyright over their work. To ensure security and permanent accessibility, BMC supports other international digital repositories and encourages self-archiving by authors. All research published in a BMC journal is immediately archived in PubMed Central and is indexed in PubMed. Because of the relative newness of the BMC journals, only seven BMC titles had citations tracked and impact factors assigned through ISI in 2002. To remedy this, BMC states on its Website its intent to develop additional methods for assessing impact on the article level, in addition to the journal title, "using a combination of editorial and peer judgments, as well as citation rates and usage statistics" [27]. BMC is compliant with the Open Archives Initiative Metadata Harvesting Protocol,<sup>‡‡</sup> which sets the standards for exposing the metadata that describes digital content and makes it accessible for automatic retrieval. Metadata for all BMC articles is available in Dublin Core to assure interoperability as global networks are built.

Instead of charging libraries and users for access to the published research, both PLoS and BMC follow a model of charging authors an article-processing charge to offset the costs of reviewing and publishing the work. PLoS charges \$1,500 per article, while BMC has an average fee of \$500 per article. BMC also offers annual institutional memberships that enable authors affiliated with those institutions to have their article-processing fees waived. Nearly 400 universities and research institutions in 32 countries have joined BMC, with most members from the United Kingdom and United States [28].

While some may find the practice of charging authors untenable, it should be pointed out that it has long been the custom of many journals to pass page and color charges on to authors. In many ways, it makes sense to put the cost burden on authors, because they receive the most immediate rewards from the publication of their work in the form of professional recognition and advancement. The prestige of an institution is also enhanced by publication of research by its affiliated researchers. Furthermore, if this cost recovery model becomes the dominant one for open access publishing, it is possible that most charges will be assumed by the institution in the form of institutional memberships or by the agencies funding the research. Currently, many funding agencies, in-

cluding the US National Institutes of Health, allow grant funds to pay for these publication charges.

Another encouraging development is the move on the part of universities and other research institutions to create institutional repositories that can house in digital form the intellectual output from their faculty, researchers, and staff. By capturing and preserving this intellectual property—which may include such scholarly content as preprints, peer-reviewed articles, conference papers, and data sets—institutions can better manage and disseminate scholarly research without relying on the traditional scholarly publishing model. Disciplinary repositories, in such diverse areas as physics and library and information science, have also emerged and allow authors to self-archive their work in much the same way. The real power of both types of repositories is realized in their support of open access as well as the potential for performing searches across repository types. This provides the foundation on which to build global networks that enable research to be searched and shared across institutions. Institutional and disciplinary repositories hold great promise in their potential for eliminating access barriers and offering the widest dissemination of scholarly research [29].

One of the pioneers in this area is D-Space,<sup>§§</sup> a free, open source software platform created by the Massachusetts Institute of Technology Libraries and the Hewlett-Packard Company. D-Space enables an institution to establish a digital asset management system that makes it easy for faculty and researchers to submit digital files and creates an infrastructure for storing, managing, and distributing those files. In addition, it supports the use of metadata to describe the files and allow them to be searched, located, and retrieved. The D-Space Federation has been created to include other large research institutions for the purpose of exploring how the D-Space platform can be adapted for use at other institutions and assessing interoperability capabilities.

The Digital Library of Information Science and Technology (DLIST)<sup>\*\*\*</sup> is an example of a disciplinary repository and is managed through the University of Arizona's School of Information Resources and Library Science and runs on another archive-creating platform called EPrints2. Designed to enable researchers and practitioners in the library and information sciences to archive both published and unpublished work, DLIST accepts instructional materials, pathfinders, bibliographies, and infometrics materials, in addition to the examples of content mentioned earlier. While authors benefit from having a single site to archive their work, the profession benefits from the ability to freely access their contributions and to share information and knowledge. DLIST is compliant with the Open Archives Initiative.

<sup>††</sup> The BioMed Central Website may be viewed at <http://www.biomedcentral.com>.

<sup>‡‡</sup> The Open Archives Initiative Metadata Harvesting Protocol Website may be viewed at <http://www.openarchives.org>.

<sup>§§</sup> The D-Space Website may be viewed at <http://www.dspace.org>.

<sup>\*\*\*</sup> The Digital Library of Information Science and Technology Website may be viewed at <http://dlist.sir.arizona.edu>.

## CONCLUSION

While progress has been made in creating new models for disseminating scholarly and scientific research, many barriers must be overcome. Academic institutions, where much of the original research is conducted, are heavily vested in the traditional publishing model by virtue of the long entrenched requirement to "publish or perish" that is a determining factor for the promotion and tenure of faculty. Established faculty members often have forged strong relationships with prestigious print journals in their fields and are likely to view newly created online journals with suspicion and distrust. These faculty members sit on tenure committees and decide the future of junior faculty. For this reason, tenure-seeking faculty naturally adopt a more conservative approach and shun the newer, less-established journals, an obstacle that may keep these journals from gaining the foothold they need to compete.

Because of this resistance to change, open access publishers, including BMC and PLoS, are approaching funding agencies such as the US National Institutes of Health to promote the benefits of publishing research results through open access publishers. Also, the US Congress has shown interest in requiring that the dissemination of scientific work funded by the federal government be done in such a way as to enhance the public's access. It will be a victory for the open access movement, when funding agencies underwrite grants with the requirement that research be published in an open access environment.

As hospital libraries move away from print, it will be important to find a way to survey prices for electronic subscriptions separate from their print counterparts, something that is impossible at the present time due to the practice of price discrimination, bundling, and other pricing techniques. Where a print subscription to a particular journal title was the same for any library regardless of size, a subscription to the electronic version will vary widely from library to library, based on a number of factors such as what the size of the library is, how many users the library has, and whether the title was purchased as a packaged deal with other titles by the publisher. These inconsistencies will make it difficult to continue to conduct price studies that produce reliable data with which medical librarians can analyze their budgets.

It is important for medical librarians to keep abreast of new developments in scholarly communications and to educate their users about open access publishing and other models for disseminating scientific and medical research. There will likely be more experimentation and innovation, before it becomes clear which new models and initiatives prove to be viable and sustainable over time. As new initiatives such as PubMed Central, BioOne, and BioMedCentral begin replacing the old models, it is expected that in the future a number of alternative and open access journals will be added to the "Brandon/Hill Selected List of Books and Journals for the Small Medical Library."

Anxiety over journal prices may subside in time, but funds will be needed for the new knowledge and evidence-based information tools that will likely emerge in an environment of increased accessibility and interoperability. Medical librarians will once again look to price and evaluative studies to aid them in analyzing ways to allocate limited budgets.

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